MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BST1034 – STATISTICS FOR MANAGERS

(All sections / Groups)

18 OCTOBER 2016
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **8** printed pages excluding the cover page, with 4 questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

Question 1:

a. The number of car sold per month by a sample of forty car sale advisors are summarized in the table below:

Number of car	Number of sale advisors
0 to less than 5	8
5 to less than 10	11
10 to less than 15	14
15 to less than 20	5
20 to less than 25	2

i. Calculate the mean of the data. (3 marks)
ii. Calculate the variance of the data. (4 marks)
iii. Calculate the median of the data. (3 marks)
iv. Calculate the mode of the data. (3 marks)

b. The housing loan application records of a bank show that 32% of its customers housing loan applications were unsuccessful. If a random sample of ten different housing loan applicants is selected, what is the probability that,
i. all ten applicants will secure their loans? (3 marks)
ii. at least two housing loan applications will be rejected? (3 marks)

c. If the housing loan amounts are known to be normally distributed with a mean of RM386000 and a standard deviation of RM4280.
i. What is the probability that a randomly selected housing loan amount is less than RM400000? (3 marks)
ii. Determine the loan amount (in RM) such that only 15% of the housing loans will be higher than this amount. (3 marks)

(Total: 25 Marks)

Continued.....

Question 2:

a. The number of housing loan applications in ten branches of a bank in this year is as follows:

452 451 570 469 388 573 394 396 478 567

i. Construct a 99% confidence interval for the average number of housing loan applications in all bank branches. (7 marks)

ii. If the average number of housing loan applications in all the branches of the bank is 498 applications last year, test at 10% level of significance whether the average number of housing loan applications has decreased this year. (8 marks)

b. The following data shows the total sales (in RM million) of insurance policies achieved by two random samples of insurance agents selected from two insurance agencies.

Agency A	Agency B
$\sum x_A = 34.26$	$\sum x_B = 40.12$
$n_A = 6$	$n_B = 7$
$s_A^2 = 2.42$	$s_B^2 = 3.18$

If we assumed that the population variances are equal and the sample variances (s_A^2 and s_B^2) are as given, can we conclude that the mean total sales of insurance policies achieved by Agency A is less than the one achieved by Agency B at the 5% significance level? (10 marks)

(Total: 25 Marks)

Continued.....

Question 3:

a. The marketing director of a car manufacturer is analyzing the yearly car sales (in unit) by four car dealers (A, B, C, and D) in different cities. The descriptive statistics and the partially completed analysis of variance table of the average yearly car sales by random samples of car sales advisors of the four car dealers are reported in the following tables:

SUMMARY

Dealer	Count	Mean	Variance
A	6	230.5	17043.10
B	5	259.8	37929.70
C	8	253.5	11627.14
D	6	265.0	38860.40

ANOVA

Source of Variation	*SS*	*df*	*MS*
Between Groups	4109.7	***	***
Within Groups	***	21	***
Total	***	24	

i. Compute the sum of squares within (*SSW*) the groups and hence complete the ANOVA table. (4 marks)

ii. By assuming that the populations have equal variances and are normally distributed, can the marketing director conclude that there is a difference in the car sales in different cities at the 5% significance level? (8 marks)

b. The marketing director of a car manufacturer would like to find out whether there is a relationship between the age (rounded to the nearest year) of car sale advisors and the average monthly car sales (in unit). The related information of fifty randomly selected car sale advisors is presented in the following table:

Car sales (in unit)	Age		
	24 – 34	35 – 45	46 – 56
4 – 9	7	6	8
10 – 15	2	3	5
16 – 21	9	4	6

Are the age of car sale advisors and the average monthly car sales related at the 10% significance level? (13 marks)

(Total: 25 Marks)

Continued.....

Question 4:

a. Study has shown that the monthly sales of cars (in unit) are related to the working experience of the car sale advisor (rounded to the nearest year). The following data is collected from a random sample of twelve car sale advisors:

Working experience	14	18	8	9	8	9	2	8	4	11	20	15
Car sales	9	10	6	7	6	15	8	8	9	5	17	18

i. Compute the coefficient of correlation. (3 marks)
ii. Find the regression line of the monthly car sales. (5 marks)

b. The following is the partially completed output of the total yearly car sales of a car manufacturer regressed on the car quality, the car price, the car dealer location, and the promotion offered:

Source of Variation	*SS*	*df*	*MS*
Regression	***	4	**
Residual	15356.0	**	**
Total	27640.8	26	

Variable	*t Stat*
Quality	3.8241
Price	4.2787
Location	–1.2005
Promotion	2.9333

i. Complete the ANOVA table. (3 marks)
ii. Test whether the regression model is statistically significant at the 1% significance level. (8 marks)
iii. Would you consider omitting any variable at the 5% significance level? Why? (6 marks)

(Total: 25 Marks)

Continued.....

APPENDIXES:

I. STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Ungrouped Data:

Sample Mean, $\bar{x} = \frac{\sum x}{n}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum x^2}{n-1} - \frac{(\sum x)^2}{n(n-1)}}$

Grouped Data:

Sample Mean, $\bar{x} = \frac{\sum fx}{\sum f}$ Sample Standard Deviation, $s = \sqrt{\frac{\sum fx^2}{\sum f - 1} - \frac{(\sum fx)^2}{\sum f(\sum f - 1)}}$

$$\text{Median} = L_m + \left[\frac{\left(\frac{\sum f}{2} - F_{m-1}\right)}{f_m}\right]c \qquad \text{Mode} = L_m + \left[\frac{(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}\right]c$$

B. PROBABILITY DISTRIBUTION

Poisson Probability Distribution

If X follows a Poisson Distribution P (λ) where $P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$

then the mean = E(X) = λ and variance = VAR(X) = λ

Binomial Probability Distribution

If X follows a Binomial Distribution B(n, p) where $P(X = x) = {}^nC_x p^x q^{n-x}$

then the mean = E(X) = np and variance = VAR(X) = npq where $q = 1-p$

Normal Distribution

If $X \sim N(\mu, \sigma)$ where E(X) = μ and VAR(X) = σ^2, then $Z = \frac{X - \mu}{\sigma}$

C. HYPOTHESIS TESTING

One Sample Mean Test

***Z*-test:** $Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ ***t*-test:** $t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$

One Sample Proportion Test

$$Z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$$

Continued.....

C. HYPOTHESIS TESTING

Two Sample Mean Test

Z-test: $$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

t-test: $$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_p\sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad \text{where } s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

Two Sample Proportion Test

$$Z = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{p}(1 - \bar{p})\left[\frac{1}{n_1} + \frac{1}{n_2}\right]}} \quad \text{where} = \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

D. ANALYSIS OF VARIANCE

$$SST = \sum_{i=1}^{k}\sum_{j=1}^{n_j}\left(X_{ij} - \bar{\bar{X}}\right)^2 \qquad SSB = \sum_{i=1}^{k} n_i\left(\bar{X}_i - \bar{\bar{X}}\right)^2$$

$$SSW = \sum_{i=1}^{k}(n_i - 1)s_i^2 \quad \text{or} \quad SSW = \sum_{i=1}^{k}\sum_{j=1}^{n_j}(x_{ij} - \bar{x}_i)^2$$

E. CHI-SQUARE ANALYSIS

Expected cell frequencies for Independent Test: $$e_i = \frac{row\ total \times column\ total}{n}$$

Chi-Square test statistic: $$\chi^2 = \sum \frac{(o_i - e_i)^2}{e_i}$$

o_i = observed frequency in a particular cell

e_i = expected frequency in a particular cell

F. REGRESSION ANALYSIS

Correlation Coefficient: $$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Simple Linear Regression: $Y = a + bX$ where $$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$ and $a = \bar{y} - b\bar{x}$

Continued.....

G. INDEX NUMBERS

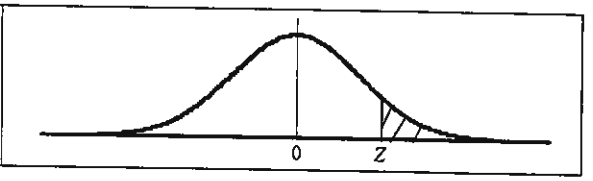
Simple Price Index $P = \frac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \frac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Simple Aggregate Price Index $P = \frac{\sum p_t}{\sum p_0} \times 100$	**Paasche Quantity Index** $P = \frac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \frac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$
Paasche Price Index $P = \frac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \frac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

Continued.....

II. STATISTICAL TABLE

Table 1

The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

End of Page